

1/12°North Atlantic HYCOM Development

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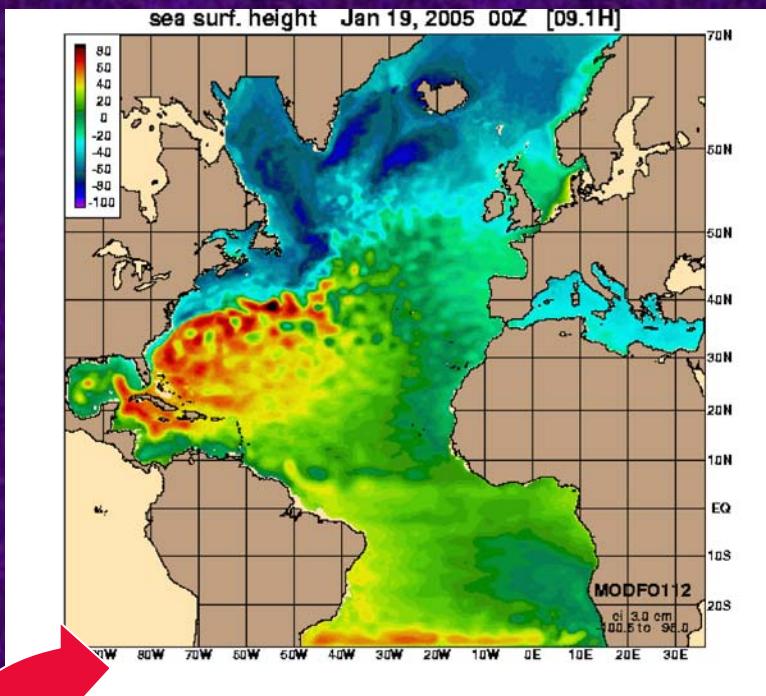
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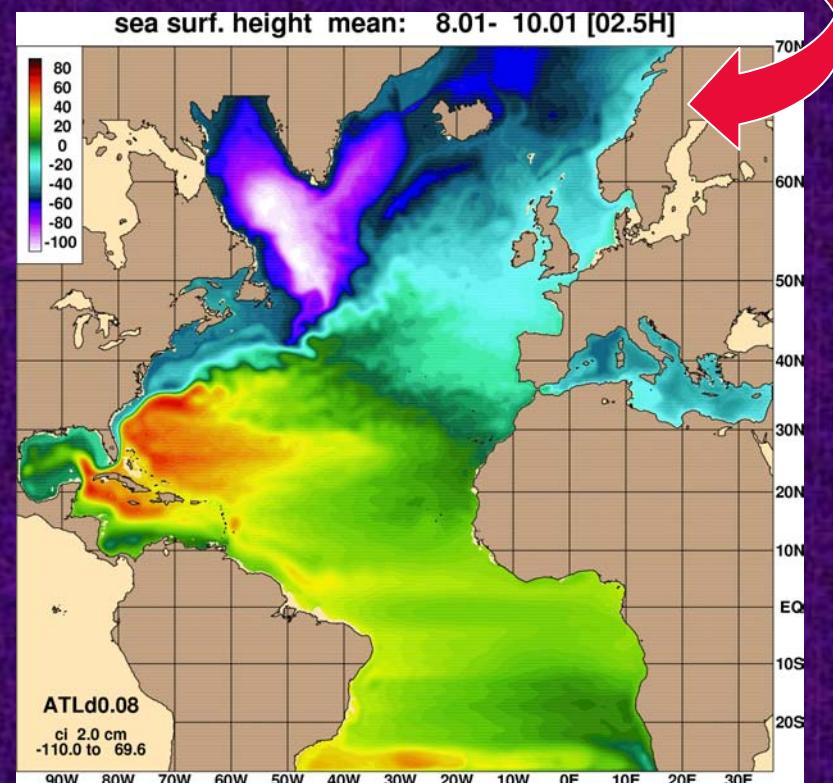
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Motivation: Improved Model Component in 1/12° Atlantic-HYCOM Nowcast/Forecast System



Present Day Near Real Time
Data-assimilative Run
(<http://www7320.nrlssc.navy.mil>)



Two-Year Mean SSH

Atlantic Basin-Scale Model Evaluation Methodology: First Order Requirements

Mean and Variability of large-scale currents

Realism of wind-driven flow

Meridional Overturning Cell (thermohaline driven)

Amplitude

Characteristics of deep southward and
upper return flow

Transports

Through passages

Within major currents

Water mass distribution

1/12° ATL-HYCOM Development

Boundary relaxation time scale

Impact on MOC amplitude

Advection scheme (MPDATA vs FCT2)

Impact on subpolar gyre mixed layer depth

Impact on MOC amplitude

Vertical coordinate:

σ_0 w/ and w/o variable target ρ

Impact Mediterranean circulation

σ_2^*

Impact on Mediterranean salinity outflow

Impact on AABW

Bottom topography (sills)

Impact on flow pathways

Diffusion parameterization

Impact on major currents (strength and pathway) and energy levels

Wind Forcing

Impact on large-scale current systems

Turbulent mixing scheme

Impact on diffusion

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1/12° Atlantic HYCOM Configuration

28°S to 70°N; 1/12° (7 km mid-lat); 26 or 28 layers; σ_0 or σ_2^*

Topography from NRL-DBDB2
Hand edited after interpolation to model grid

Monthly GDEM3 climatology
Initialization (July); SSS and lateral open boundary relaxation

KPP or GISS turbulent mixing model

ERA-15 monthly mean forcing + high-frequency wind anomalies
Corrected strength of winds

River runoff included
Major rivers only at this time

kpar turbidity

Bulk formulation for sensible and latent heat fluxes

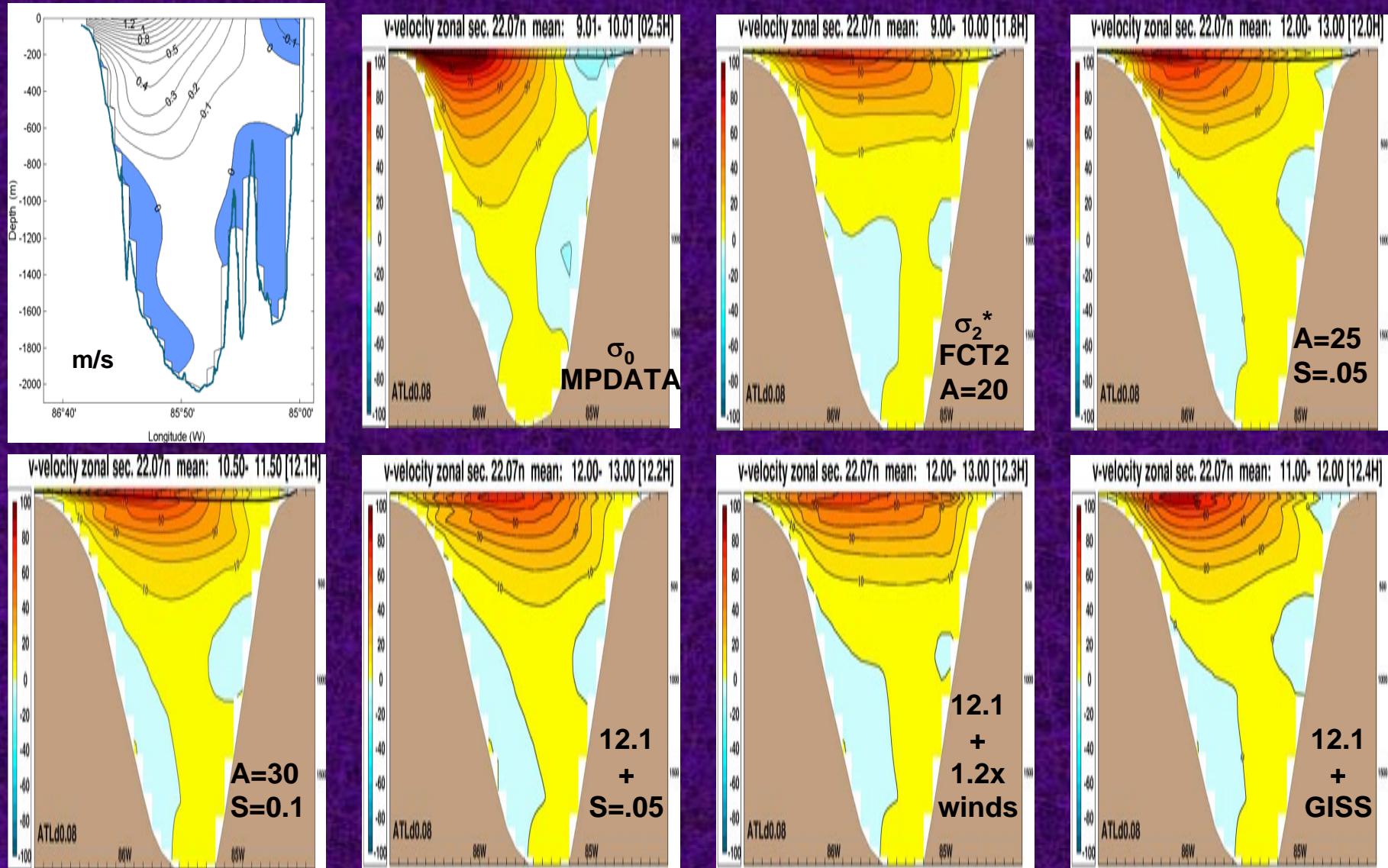
Energy loan ice model

1/12° ATL-HYCOM Twin Experiments

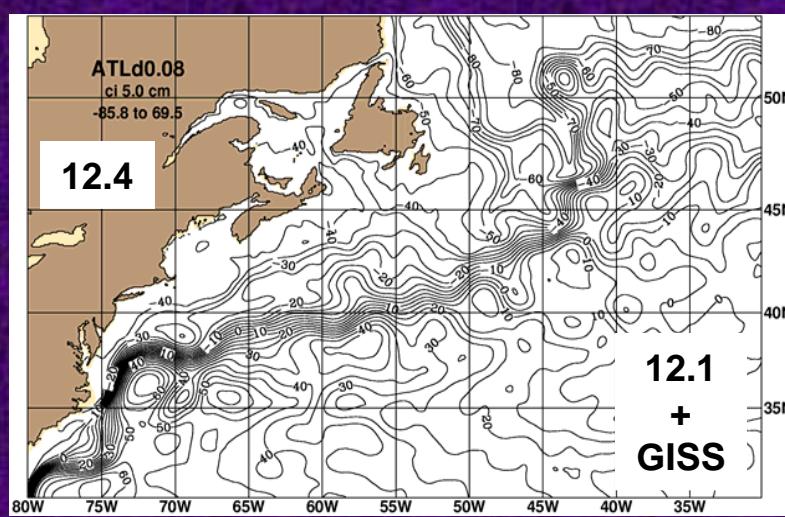
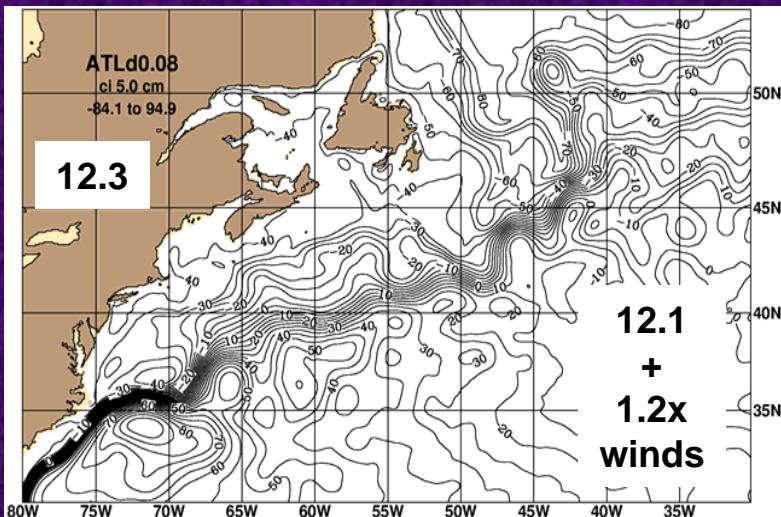
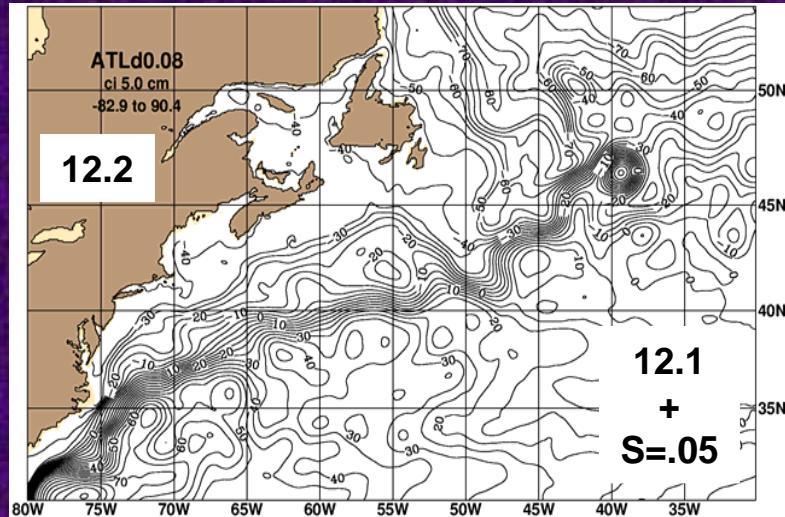
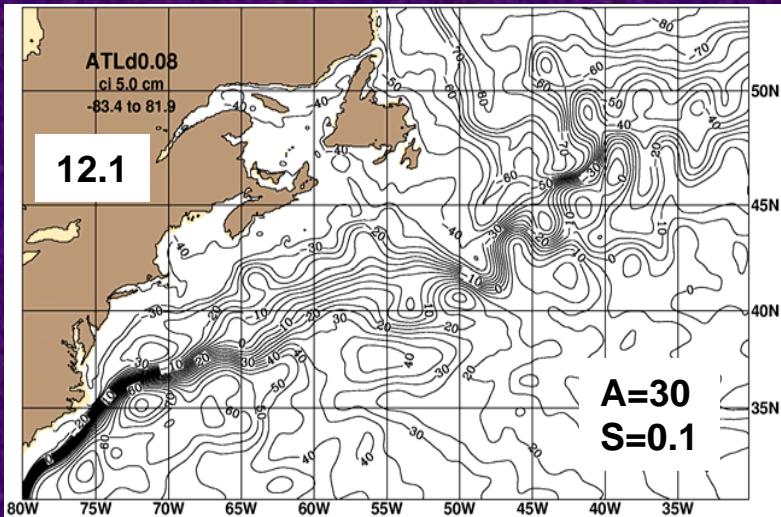
Experiment	Smag. Diffusion	Spatially Constant A	Mixed Layer	Model Years	C_b	Other
ATLd0.08-11.8	.05	20	KPP	09-10	.02	Improved WWI sills
ATLd0.08-12.0	.05	25	KPP	11-13	.022	Improved FS sill
ATLd0.08-12.1	.1	30	KPP	11-15	.022	
ATLd0.08-12.2	.05	30	KPP	11-13	.022	
ATLd0.08-12.3	.1	30	KPP	11-13	.022	1.2x winds
ATLd0.08-12.4	.1	30	GISS	11-13	.022	

Yucatan Channel Annual Mean Velocity

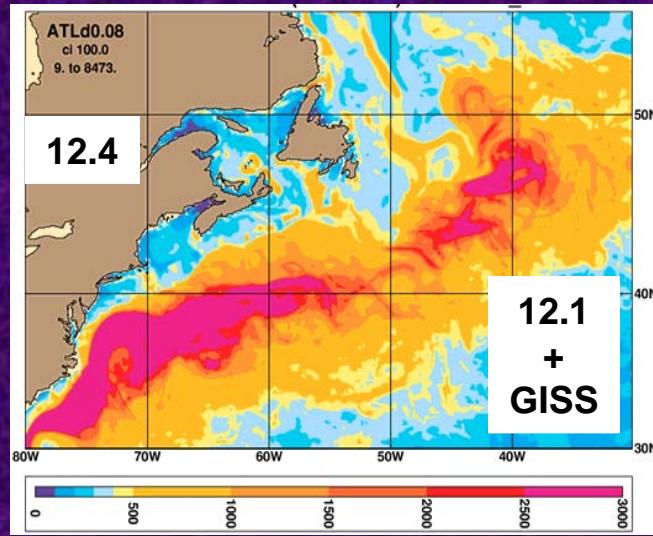
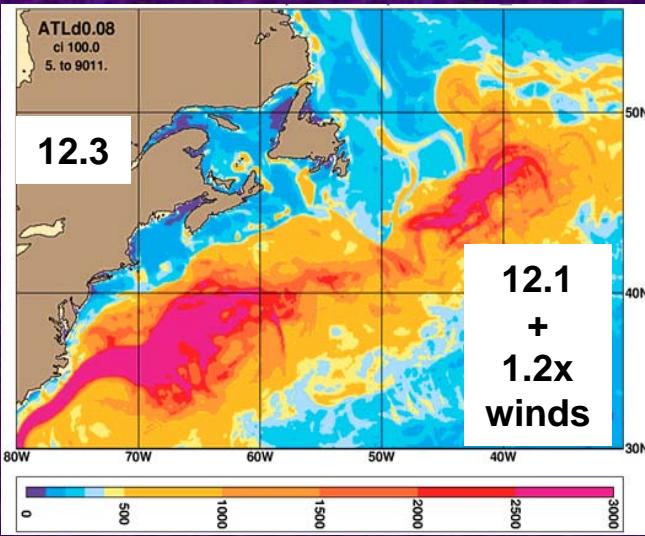
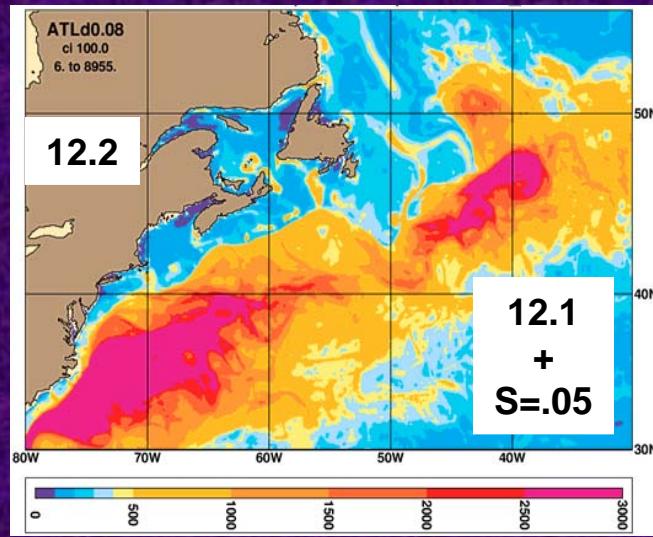
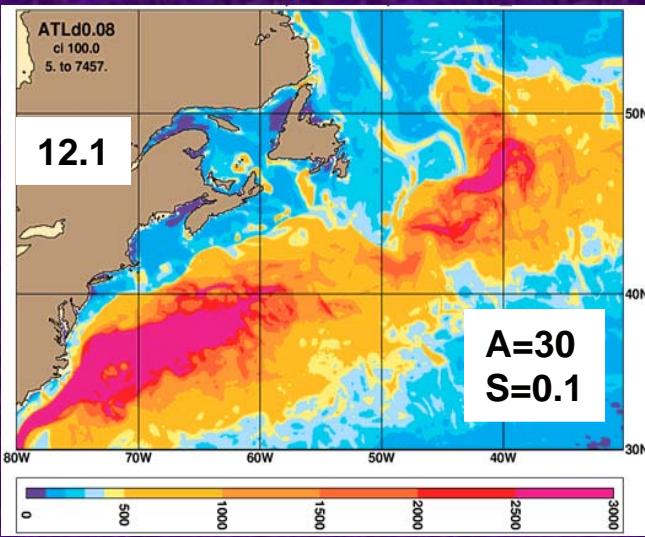
1/12° Atlantic HYCOM



1/12° Atlantic HYCOM 2-Year Mean SSH



1/12° Atlantic HYCOM Layer 1 EKE (cm^2/s^2)



1/12° Atlantic Hycom Two-year Mean Transports*

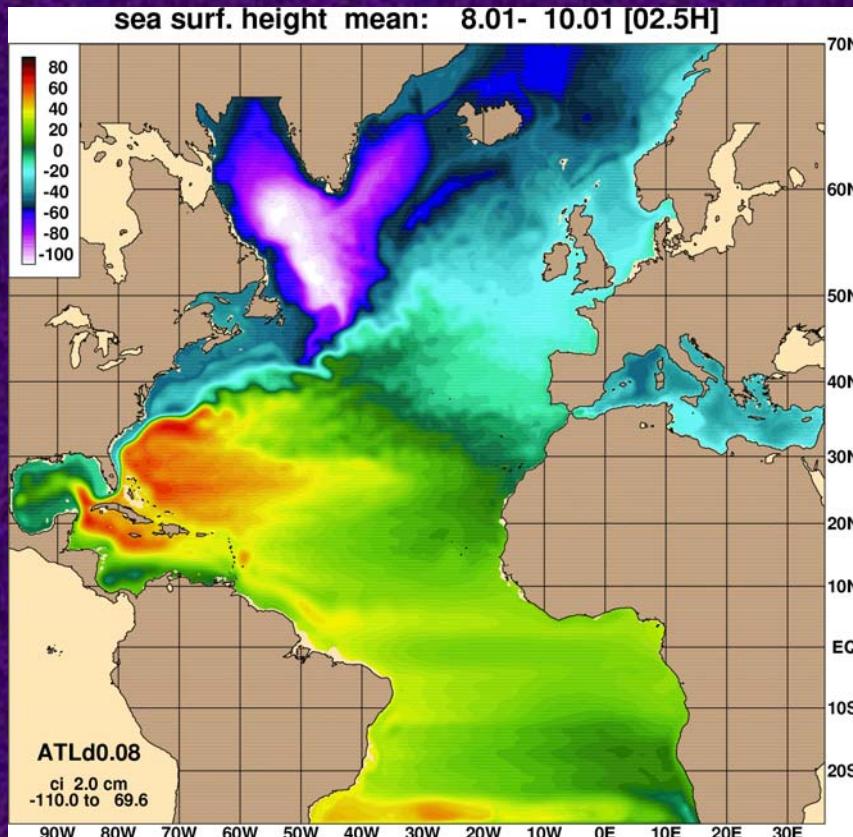
Expt.	FC 27°N	Abac (nrth)	FC + Abac	NWP	OBC	Yuc Chan	WW	Mona	Aneg	L.A. [#]	Lucia Vinc e Gren
Obs	32	5	37	-1.2	-1.9	29.2	-7.0	-2.6	-2.5	-17.1	-10.1
11.8	27.9	20.8	48.7	-3.3	1.1	25.7	-3.3	-3.8	-1.7	-16.9	-11.4
12.0	27.7	16.6	44.3	-2.7	1.1	25.8	-3.2	-5.7	-1.7	-15.5	-9.9
12.1	26.8	6.8	33.6	-3.2	1.0	24.5	-3.3	-3.9	-1.3	-16.2	-10.2
12.2	27.4	7.4	34.8	-3.6	0.9	24.7	-4.8	-3.5	-1.3	-15.2	-9.4
12.3	28.3	4.7	33.0	-4.0	1.0	25.3	-1.9	-4.9	-2.3	-16.1	-10.3
12.4	25.9	5.4	31.3	-3.1	0.9	23.7	-2.5	-3.9	-1.2	-16.2	-11.1

* Positive transport defined northward and eastward

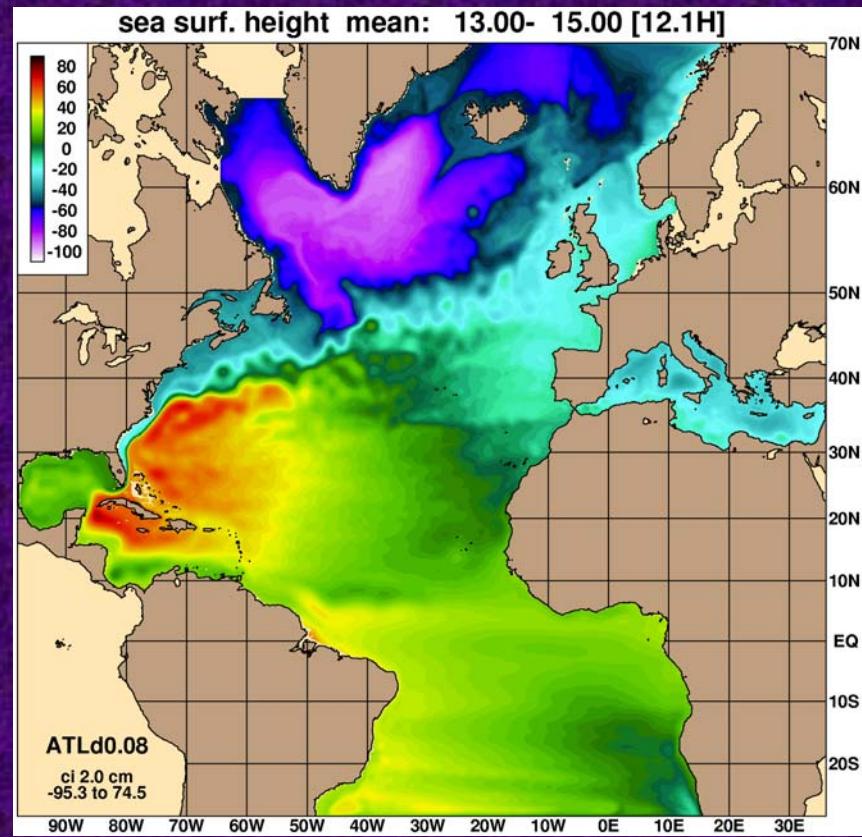
Residual of Yucatan – WW – Mona - Anegada

1/12° ATL-HYCOM Mean Sea Surface Height

Present Nowcast/Forecast System Model



Improved Model



ERA-15 wind (+ high-frequency anomalies) and thermal forcing
and relaxation to GDEM3 at northern and southern boundaries

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Variable Reference State